



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/804,449	03/19/2004	Ming-Jie Huang	67,200-1205	7283

7590 03/21/2005

TUNG & ASSOCIATES
Suite 120
838 W. Long Lake Road
Bloomfield Hills, MI 48302

EXAMINER	
GOUDREAU, GEORGE A	
ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 03/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/804,449

Applicant(s)

HUANG ET AL.

Examiner

George A. Goudreau

Art Unit

1763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected..
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

George A. Goudreau
GEORGE GOUDREAU
PRIMARY EXAMINER

3-051

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.

- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

Art Unit: 1763

1. Claims 6, 8, 10, 13, 16, and 20-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

-The phrase "fluoronitride and fluorosulfur" in claims 8, 10, and 16 are incorrect chemical nomenclature, and should be reworded in more acceptable chemical nomenclature.;

-Polysilicon is not the same compound as amorphous silicon as purported by applicant in claims 6, 13, and 20. There are three basic types of silicon. Cz-silicon (i.e.-single crystal silicon), polysilicon (multi-crystalline structure), and amorphous silicon (i.e.-no crystalline structure). Applicant should revise these claims to correct these errors in chemical nomenclature.; and

-In claims 21-22, the term "Dopant" should read "dopant".

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Art Unit: 1763

3. Claims 1-2, 4, 6-10, and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Kumar et. al. (5,851,926).

Kumar et. al. disclose a process for patterning a W polycide gate on the surface of a Si wafer which is comprised of the following steps:

- A laminate which comprised of layers of pad SiO₂ (12)/ polysi (14)/ WSi₂ (16)/ SiO₂ / photo resist (18) are formed onto the surface of a Si wafer.;
- The photo resist layer is patterned to form an etch mask.;
- The top SiO₂ layer is rie etched to form a SiO₂ hard mask.;
- The photo resist etch mask is removed from the surface of the wafer.;
- The WSi₂ (16)/ polysi (14) layers are rie etched in a plasma which is comprised of NF₃-HBr-Cl₂.; and
- The polysi layer (14) is over etched in a plasma, which is comprised of HBr-Cl₂-He-O₂.

This is discussed specifically in columns 4-6; and discussed in columns 1-6.

This is shown in figures 1-8.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 3, 5, 12, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumar et. al. as applied in paragraph 3 above.

Kumar et. al. as applied in paragraph 3 above fail to disclose the following aspects of applicant's claimed invention:

- the specific usage of pre-doped polysi for the polysi layer;
- the specific etching process conditions, which the applicant claims; and
- the specific usage of the type of rie etching apparatus, which is claimed by the applicant

It would have been obvious to one skilled in the art to employ pre-doped polysi as the polysi layer in the wafer based upon the following. The usage of pre-doped polysi to form a polysi layer in a polycide gate is conventional or at least well known in the semiconductor processing arts. (The examiner takes official notice in this regard.) Further, this simply represents the usage of an alternative, and at least equivalent means for forming the polysi layer in the polycide gate formed in the process taught

above to the specific means which are taught above. Also, it would have been desirable to employ a pre-doped polysi layer to form the polysi layer in the polycide gate in the process taught above based upon the improved conductivity of the pre-doped polysi layer over an undoped polysi layer.

It would have been obvious to one skilled in the art to employ the specific type of rie etching apparatus which is claimed by the applicant for conducting the rie etching process taught above based upon the following. The usage of the specific type of rie etching apparatus, which is claimed by the applicant to conduct a rie etching process, is conventional or at least well known in the plasma etching arts. (The examiner takes official notice in this regard.) Further, this simply represents the usage of an alternative, and at least equivalent means for conducting the etching process taught above to the specific means, which are taught above.

It would have been prima facie obvious to one skilled in the art to employ any of a variety of different etching process conditions in the etching process taught above including those which are specifically claimed by the applicant. These are all well-known variables in the plasma etching art, which are known to affect both the rate and the quality of the plasma etching process. Further, the selection of particular values for these variables would not necessitate any undo experimentation, which would have been indicative of unexpected results.

Alternatively, it would have been obvious to one skilled in the art to employ the specific process conditions which are claimed by the applicant in the etching process taught above based upon *In re Aller* as cited below.

"Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F. 2d 454, 105 USPQ 233, 235 (CCPA).

Further, all of the specific process conditions which are claimed by the applicant are results effective variables whose values are known to effect both the rate, and the quality of the plasma etching process.

7. Claims 11, and 15-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over the reference as applied in paragraph 6 above further in view of Tao et. al. (6,156,629).

The reference as applied in paragraph 6 above fail to disclose the following aspects of applicant's claimed invention:

- the specific usage of a BARC layer between the photo resist etch mask layer, and the underlying SiO₂ etch hard mask layer;
- the removal of both the photo resist mask layer, and the BARC layer after the SiO₂ etch hard mask layer has been patterned, and prior to the patterning of the polysi gate layer; and
- the specific usage of a plasma comprised of (Cl₂-Br-O₂-He) to over etch the polysi layer in the process taught above

Tao et. al. teach that it is desirable to etch a polysi layer using a SiO₂ etch hard mask, and a plasma which is comprised of (Cl₂-Br-O₂-He). They further teach that it is desirable to use a BARC layer which is sandwiched between the photo resist etch mask layer, and the SiO₂ etch hard mask layer when patterning the SiO₂ etch hard mask layer. They also teach that it is desirable to remove the BARC layer, and the

Art Unit: 1763

photo resist mask layer after the SiO₂ etch hard mask has been patterned, and prior to etching the polysi gate using the SiO₂ etch hard mask. This is discussed specifically in columns 4-8; and discussed in general in columns 1-12. This is shown in figures 1-5.

It would have been obvious to one skilled in the art to use a BARC layer in the patterning of the SiO₂ etch hard mask layer in the process taught above based upon Tao et. al. teaching that it is desirable to do so. Further, this would have provided a desirable means for improving the accuracy of the patterning of the SiO₂ etch hard mask layer by improving the resolution of the photo resist etch mask which is formed. It would have been obvious to one skilled in the art to remove the BARC layer, and the photo resist mask layer after the SiO₂ etch hard mask layer has been patterned in the process taught above based upon Tao et. al. teaching that it is desirable to do so. Further, some type of means would have needed to have been provided to remove the BARC layer from the etched substrate after it has had been used in the imaging of the photo resist etch mask layer. It would have been obvious to one skilled in the art to use a plasma comprised of (Cl₂-Br-O₂-He) to over etch the polysi layer in the process taught above based upon Tao et. al. teaching that it is desirable to do so. Further, this would have simply provided an alternative, and at least equivalent means for conducting the etching process taught above to the specific means, which are taught above.

8. Claims 1, and 5-8 are rejected under 35 U.S.C. 102(e) as being anticipated by Chan et. al. (6,828,237).

Chan et. al. disclose a process for rie etching a doped polysi gate layer using an etching hard mask layer, and a plasma etchant which is comprised of an oxygen based

Art Unit: 1763

gas, an inert gas diluent, and a fluorine based compound. The hard mask layer is comprised of any of SiO₂, Si₃N₄, or SiON. The fluorine based gas is comprised of any of SF₆, NF₃, HF, or a fluorocarbon based gas. This is discussed specifically in column 4; and discussed in general in columns 1-8. This is shown in figures 1-7.

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. (These references may be used to reject applicant's claims under either 102 or 103.)

10. Any inquiry concerning this communication should be directed to examiner

George A. Goudreau at telephone number (571)-272-1434.


George A. Goudreau
Primary Examiner
Art Unit 1763